Fig.1

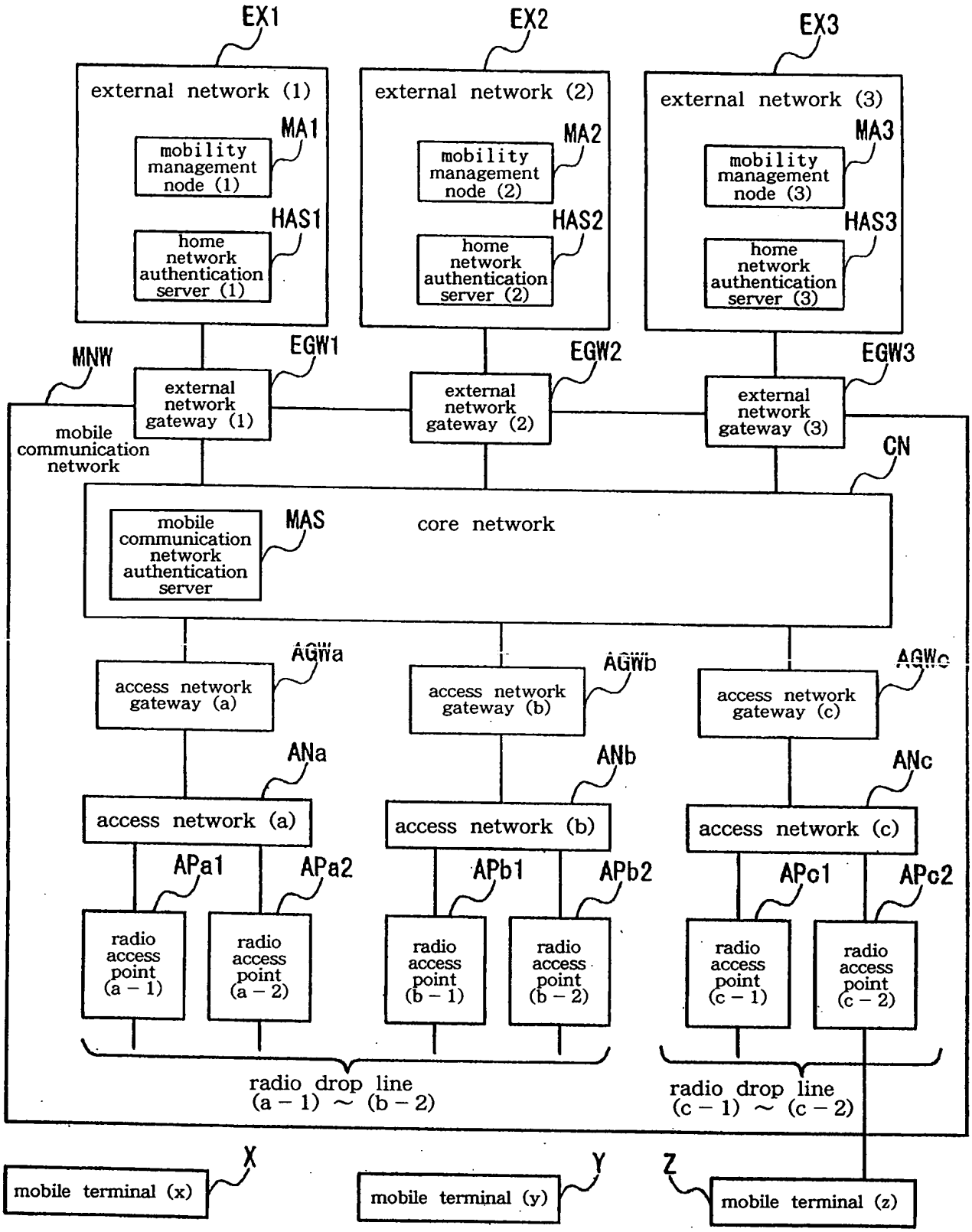

EX1
external network (1)
MA1
mobility management node (1)
HAS1
home network authentication server (1)
EX2
external network (2)
MA2
mobility management node (2)
HAS2
home network authentication server (2)
EX3
external network (3)
MA3
mobility management node (3)
HAS3
home network authentication server (3)
MNW
mobile communication network
EGW1
external network gateway (1)
EGW2
external network gateway (2)
EGW3
external network gateway (3)
CN
core network
MAS
mobile communication network authentication server
AGWa
access network gateway (a)
AGWb
access network gateway (b)
AGWc
access network gateway (c)
ANa
access network (a)
ANb
access network (b)
ANc
access network (c)
APa1
APa2
APb1
APb2
APc1
APc2
radio access point (a − 1)
radio access point (a − 2)
radio access point (b − 1)
radio access point (b − 2)
radio access point (c − 1)
radio access point (c − 2)
radio drop line (a − 1) ～ (b − 2)
radio drop line (c − 1) ～ (c − 2)
X
mobile terminal (x)
Y
mobile terminal (y)
Z
mobile terminal (z)

Fig. 2

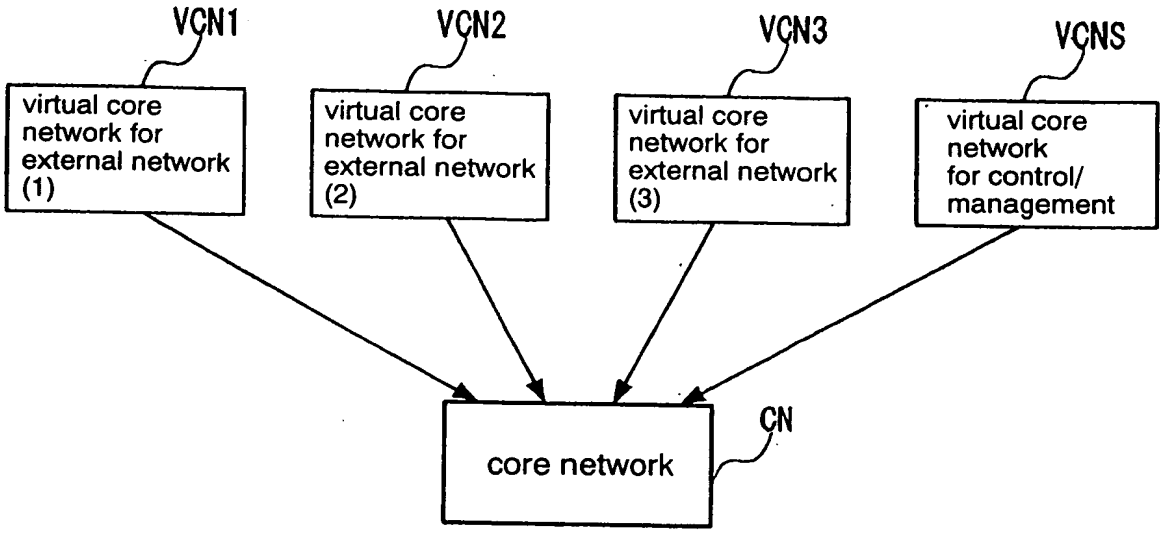

VCN1
virtual core network for external network (1)
VCN2
virtual core network for external network (2)
VCN3
virtual core network for external network (3)
VCNS
virtual core network for control/ management
core network
CN

Fig. 3

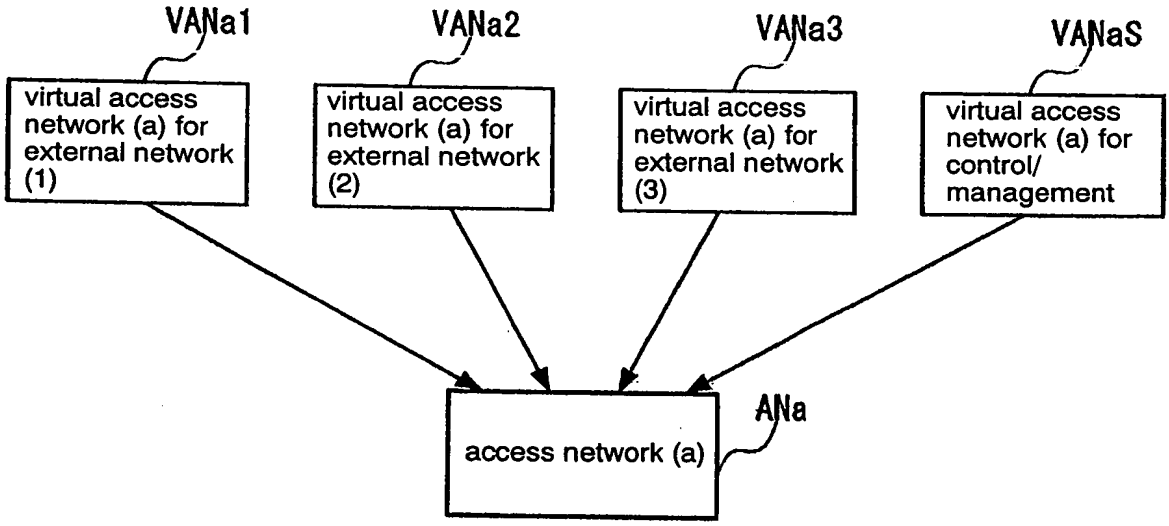

VANa1
virtual access network (a) for external network (1)
VANa2
virtual access network (a) for external network (2)
VANa3
virtual access network (a) for external network (3)
VANaS
virtual access network (a) for control/ management
access network (a)
ANa

Fig. 4

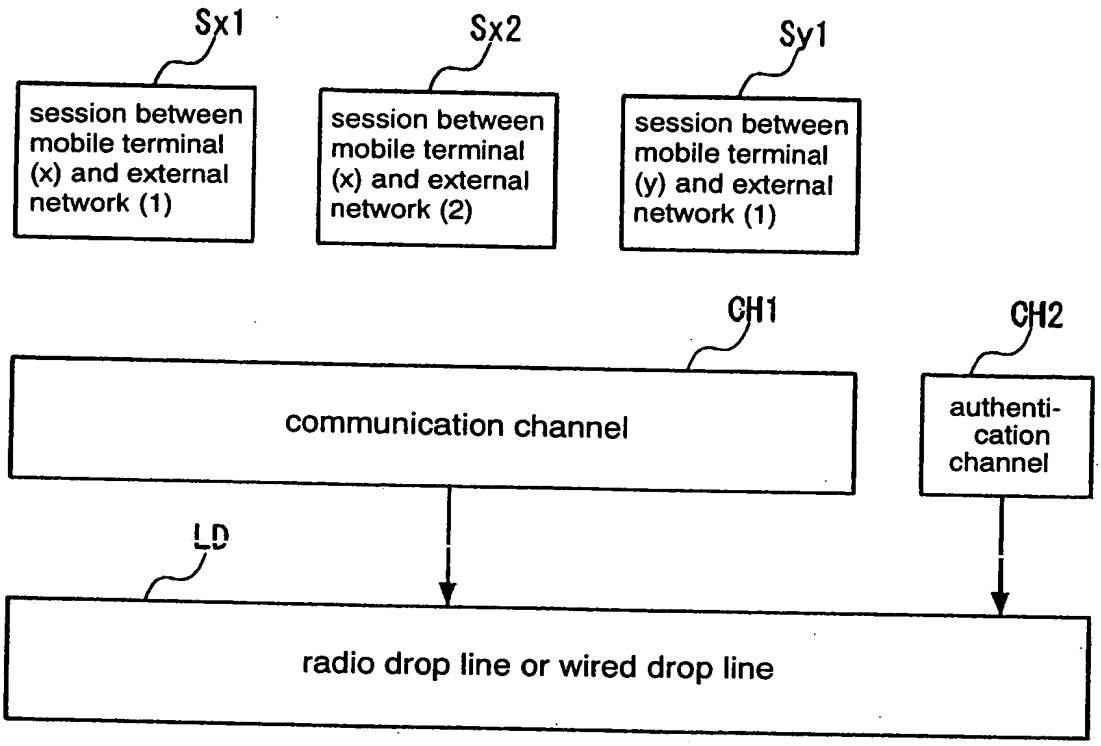

Sx1
session between mobile terminal (x) and external network (1)
Sx2
session between mobile terminal (x) and external network (2)
Sy1
session between mobile terminal (y) and external network (1)
CH1
communication channel
CH2
authenti-cation channel
LD
radio drop line or wired drop line

Fig. 5

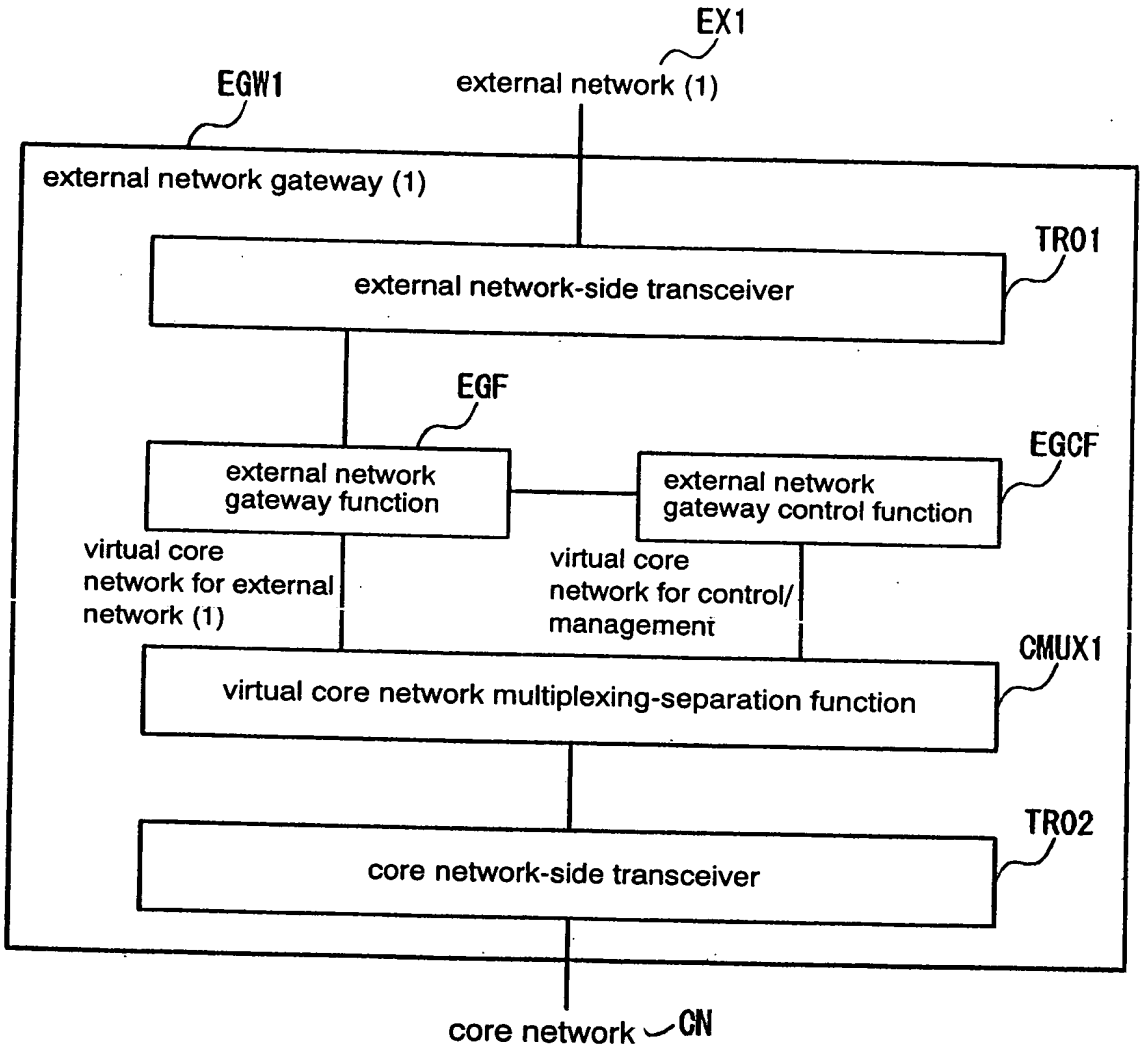

EX1
external network (1)
EGW1
external network gateway (1)
TR01
external network-side transceiver
EGF
external network gateway function
EGCF
external network gateway control function
virtual core network for external network (1)
virtual core network for control/ management
CMUX1
virtual core network multiplexing-separation function
TR02
core network-side transceiver
core network
CN

Fig. 6

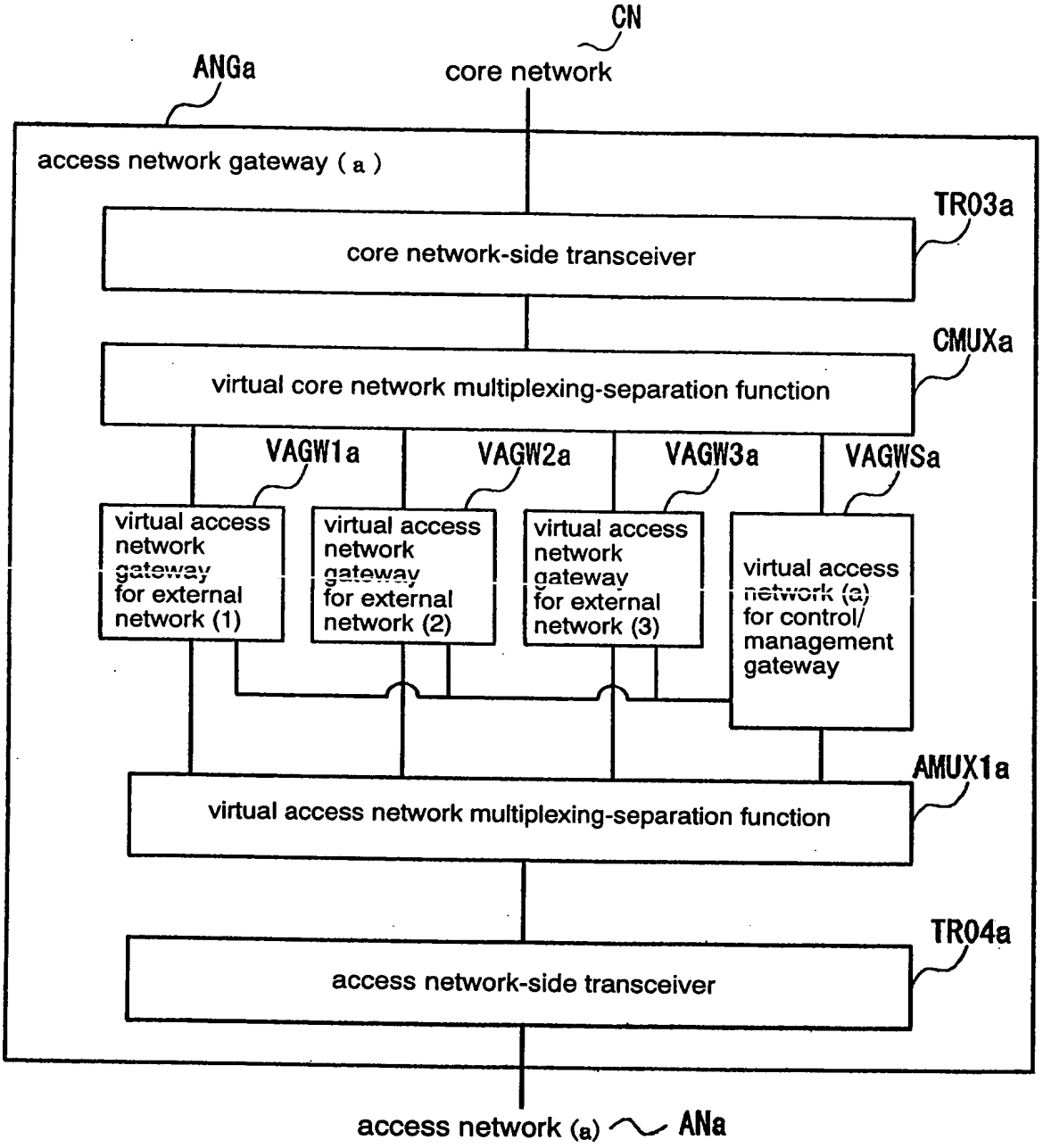

CN
core network
ANGa
access network gateway (a)
TR03a
core network-side transceiver
CMUXa
virtual core network multiplexing-separation function
VAGW1a
VAGW2a
VAGW3a
VAGWSa
virtual access network gateway for external network (1)
virtual access network gateway for external network (2)
virtual access network gateway for external network (3)
virtual access network (a) for control/ management gateway
AMUX1a
virtual access network multiplexing-separation function
TR04a
access network-side transceiver
access network (a)
ANa

Fig. 7

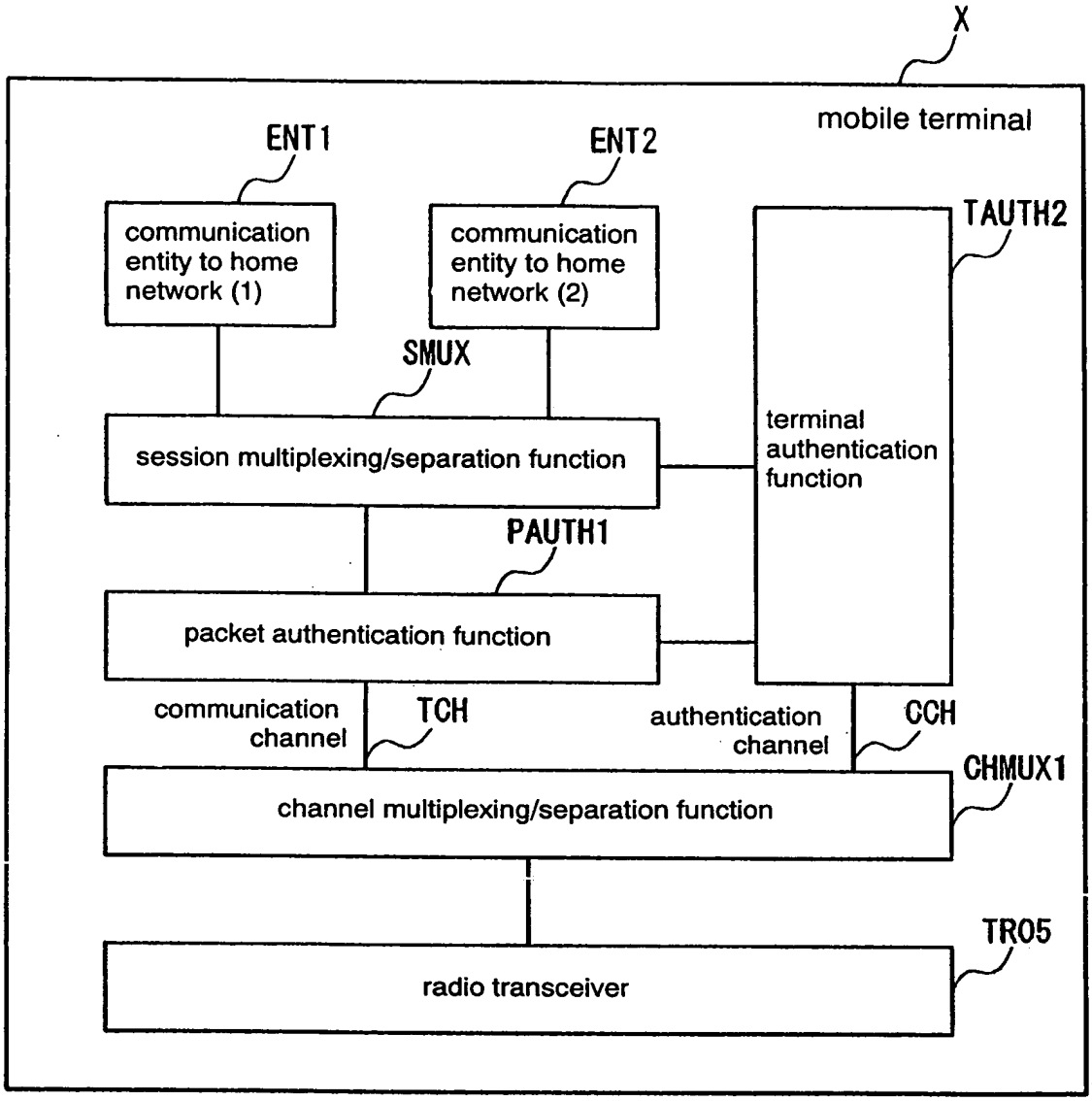

X
mobile terminal
ENT1
ENT2
communication entity to home network (1)
communication entity to home network (2)
TAUTH2
SMUX
session multiplexing/separation function
terminal authentication function
PAUTH1
packet authentication function
communication channel
TCH
authentication channel
CCH
CHMUX1
channel multiplexing/separation function
TRO5
radio transceiver

Fig. 8

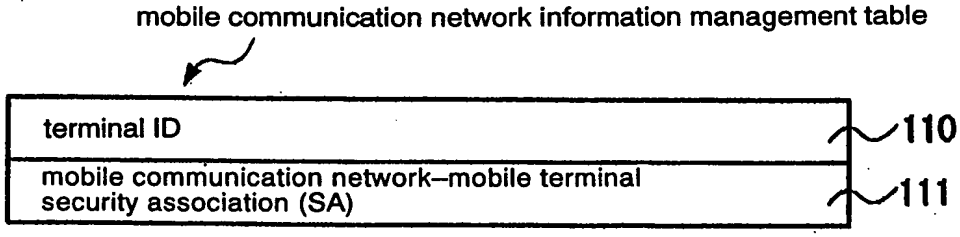

mobile communication network information management table
terminal ID
110
mobile communication network–mobile terminal security association (SA)
111

Fig. 9

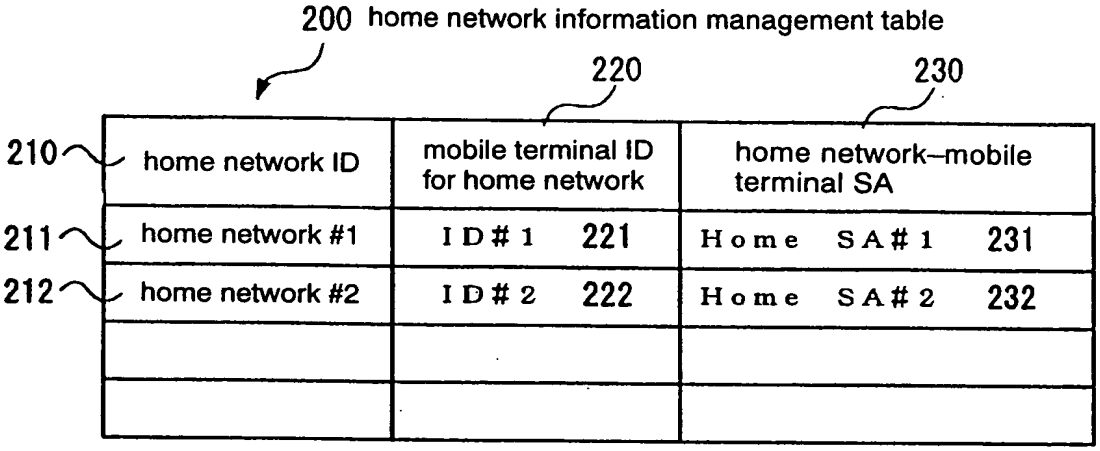

200 home network information management table
220
230
210
home network ID
mobile terminal ID for home network
home network–mobile terminal SA
211
home network #1
ID#1 221
Home SA#1 231
212
home network #2
ID#2 222
Home SA#2 232

Fig. 10

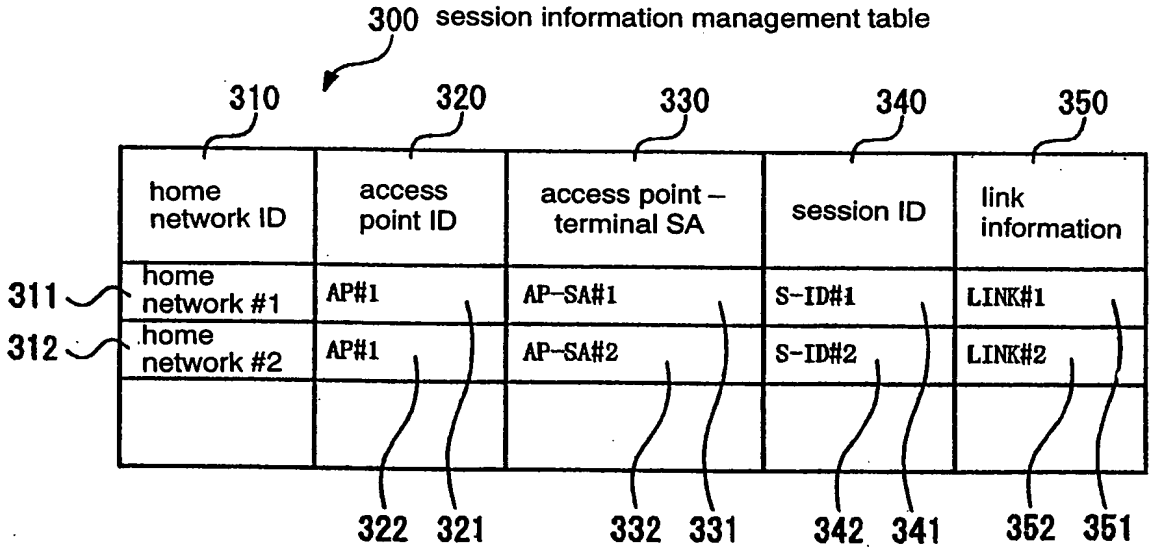

300 session information management table
310
320
330
340
350
home network ID
access point ID
access point – terminal SA
session ID
link information
311
home network #1
AP#1
AP-SA#1
S-ID#1
LINK#1
312
home network #2
AP#1
AP-SA#2
S-ID#2
LINK#2
322
321
332
331
342
341
352
351

Fig. 11

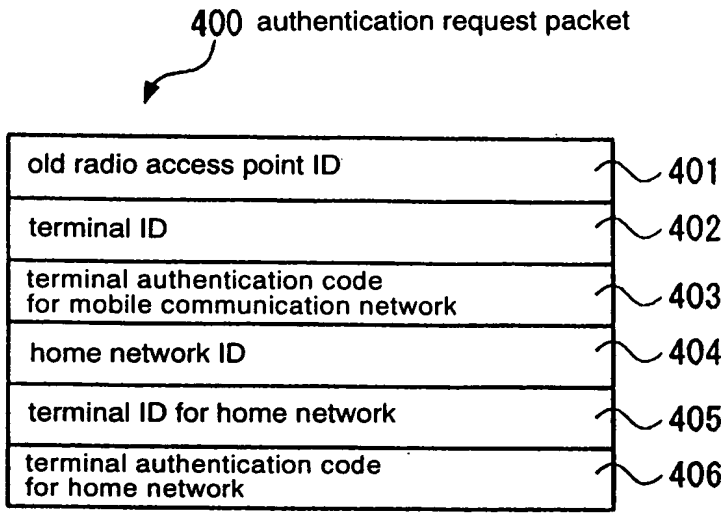

400 authentication request packet
old radio access point ID
401
terminal ID
402
terminal authentication code for mobile communication network
403
home network ID
404
terminal ID for home network
405
terminal authentication code for home network
406

Fig. 12

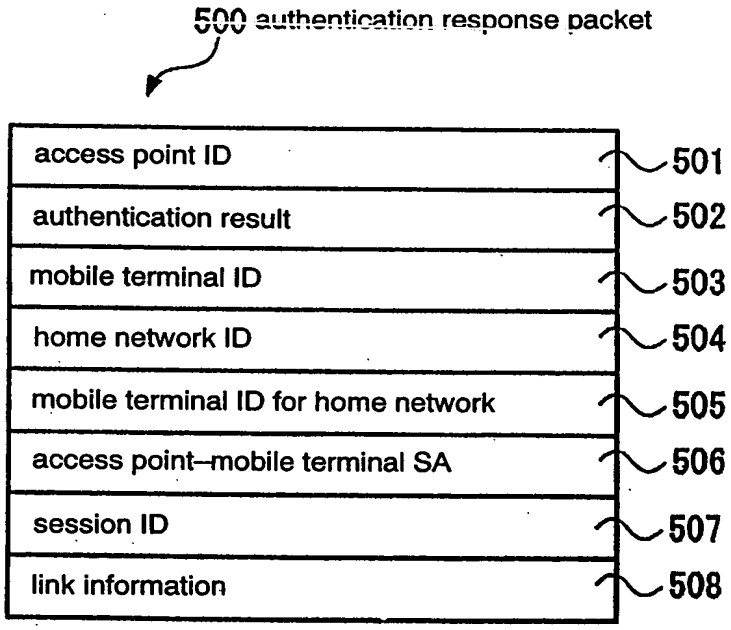

500 authentication response packet
access point ID
501
authentication result
502
mobile terminal ID
503
home network ID
504
mobile terminal ID for home network
505
access point–mobile terminal SA
506
session ID
507
link information
508

Fig.13

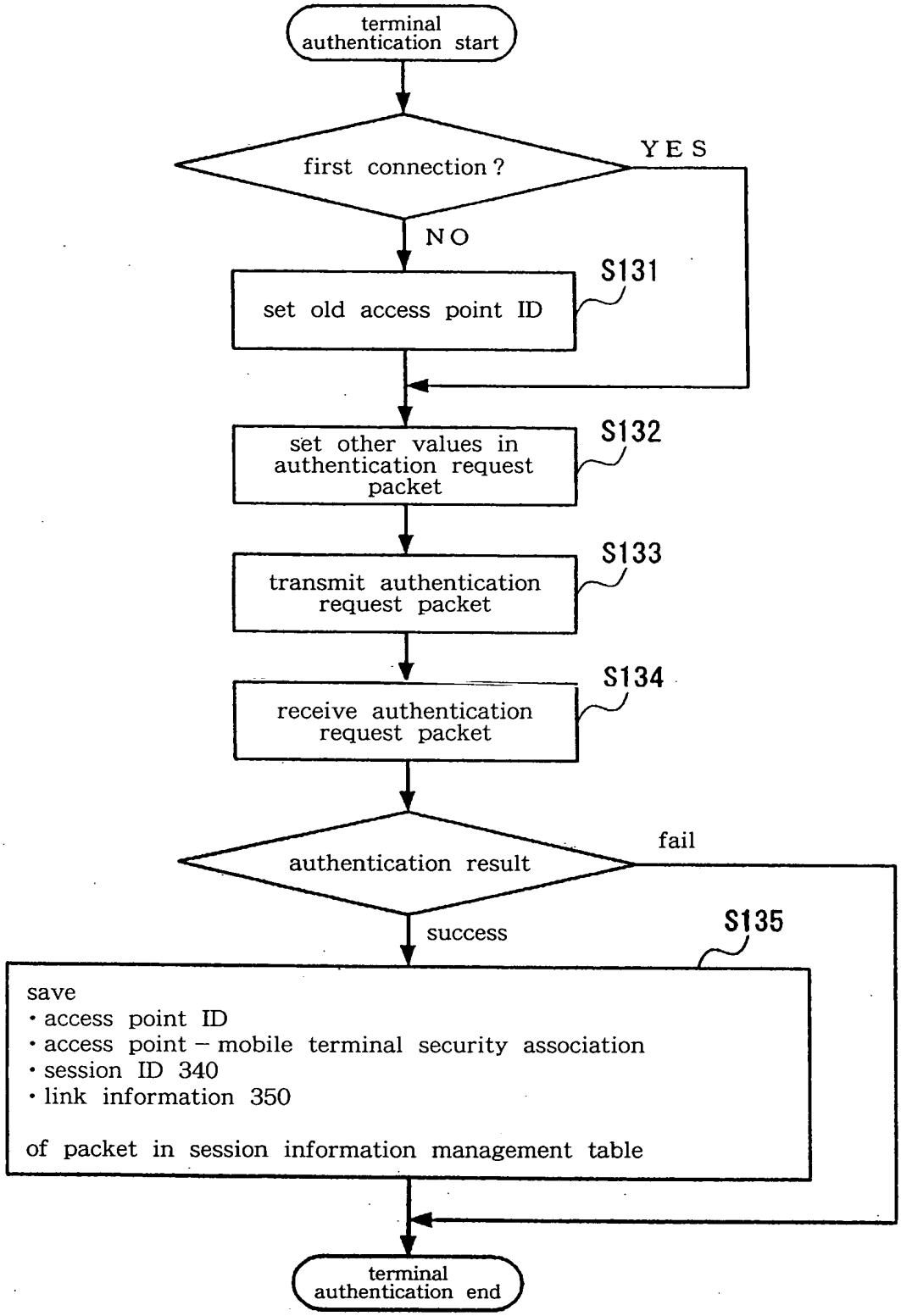

terminal authentication start
first connection ?
YES
NO
S131
set old access point ID
S132
set other values in authentication request packet
S133
transmit authentication request packet
S134
receive authentication request packet
authentication result
fail
success
S135
save
• access point ID
• access point – mobile terminal security association
• session ID 340
• link information 350
of packet in session information management table
terminal authentication end

Fig. 14

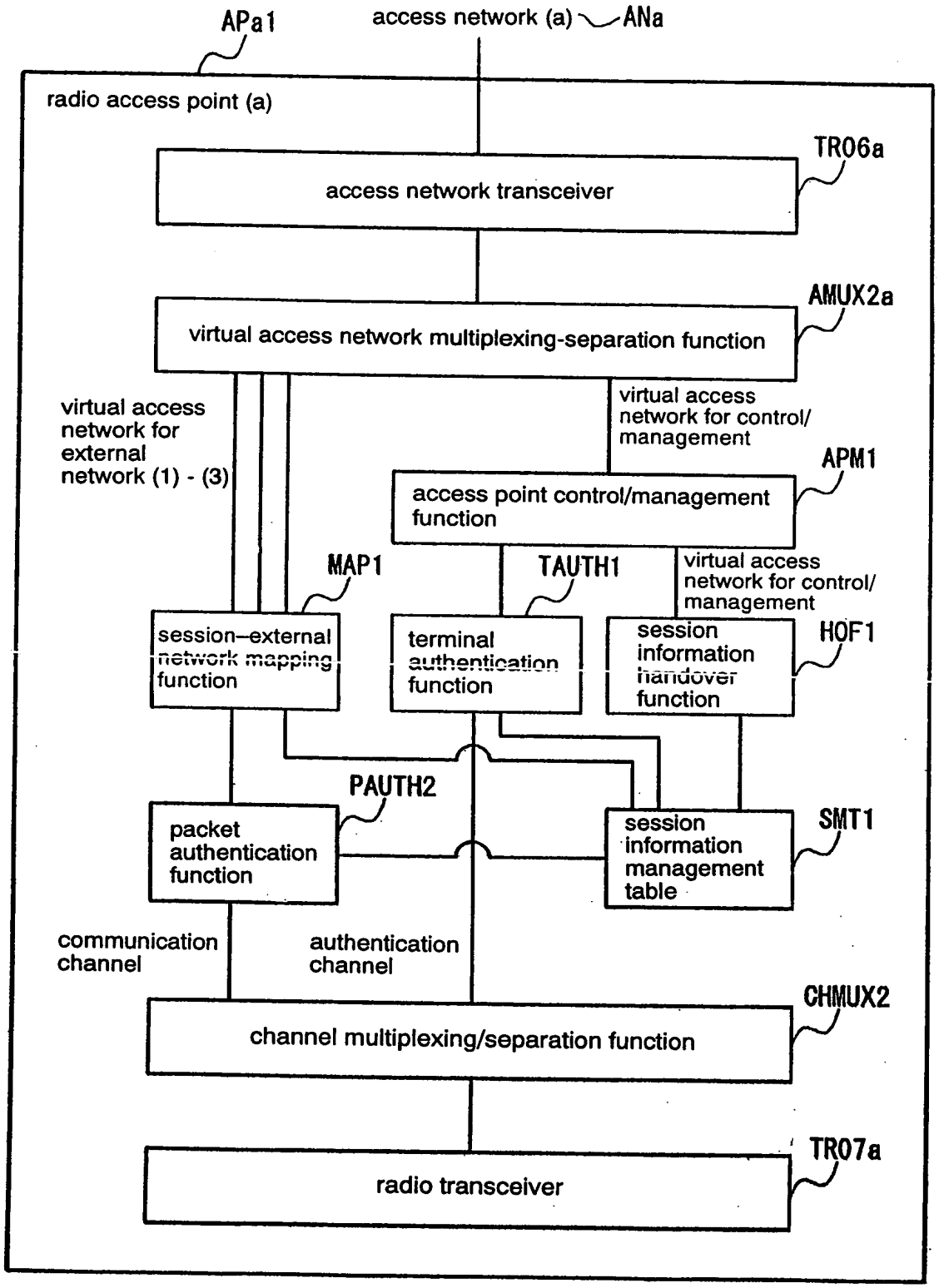

APa1
access network (a)
ANa
radio access point (a)
TR06a
access network transceiver
AMUX2a
virtual access network multiplexing-separation function
virtual access network for external network (1) - (3)
virtual access network for control/ management
APM1
access point control/management function
MAP1
TAUTH1
virtual access network for control/ management
session–external network mapping function
terminal authentication function
session information handover function
HOF1
PAUTH2
packet authentication function
session information management table
SMT1
communication channel
authentication channel
CHMUX2
channel multiplexing/separation function
TR07a
radio transceiver

Fig. 15

600 session information management table

mobile terminal ID 610	external network ID 620	access point – mobile terminal SA 630	session ID 640	link information 650
mobile terminal #1 611	external network #1 621	SA# 1 631	session #1 641	link information #1 651
mobile terminal #1 612	external network #2 622	SA# 2 632	session #2 642	link information #2 652
mobile terminal #2 613	external network #1 623	SA# 1 633	session #1 643	link information #1 653

Fig. 16

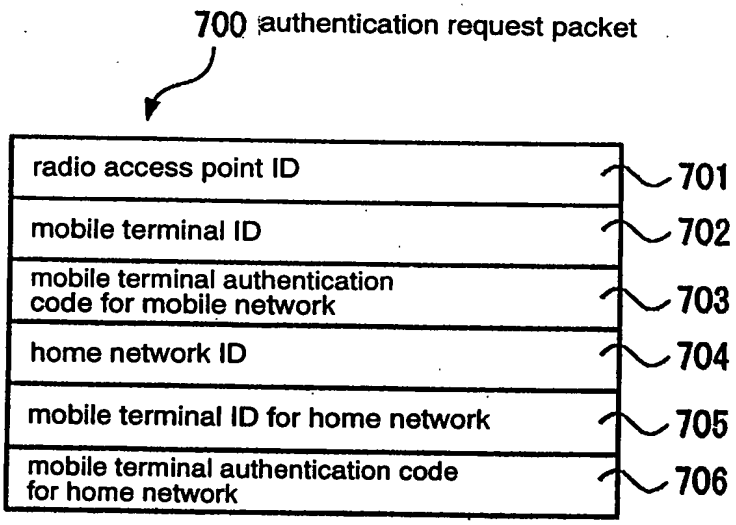


Fig. 17

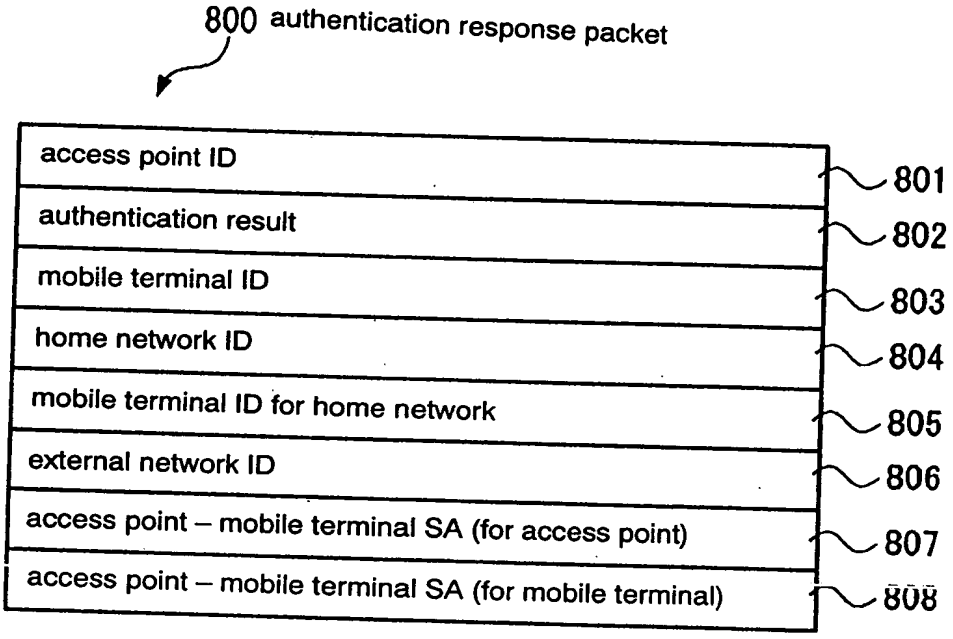

800 authentication response packet
access point ID
801
authentication result
802
mobile terminal ID
803
home network ID
804
mobile terminal ID for home network
805
external network ID
806
access point – mobile terminal SA (for access point)
807
access point – mobile terminal SA (for mobile terminal)
808

Fig. 18

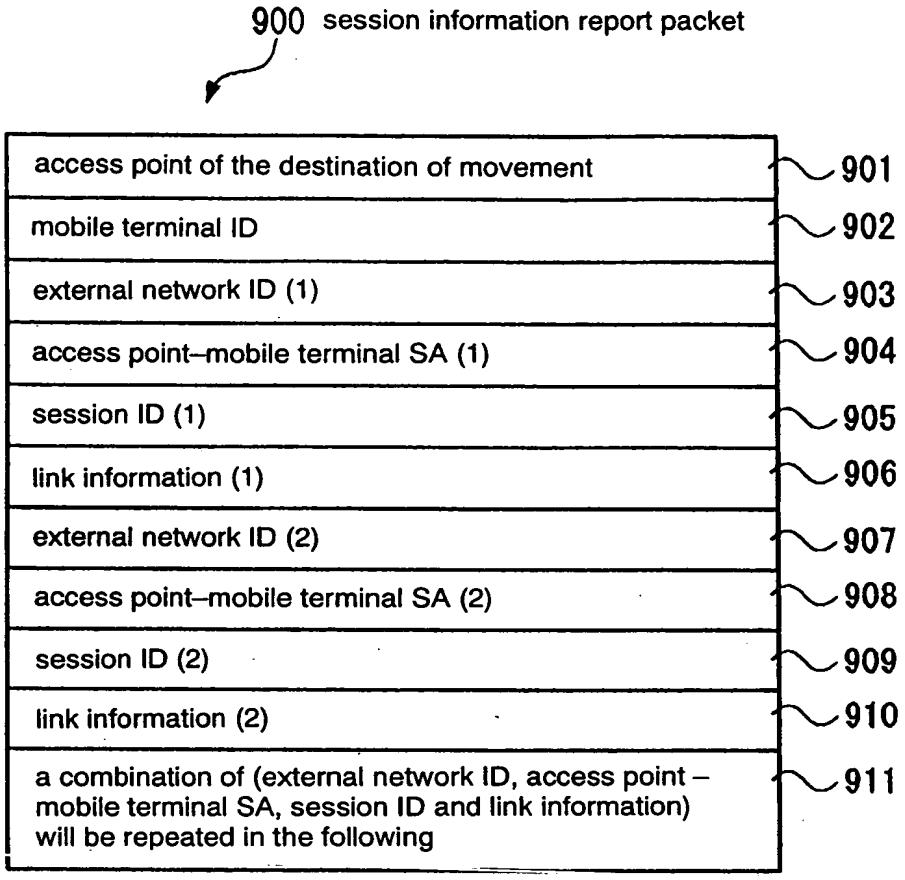

900 session information report packet
access point of the destination of movement
901
mobile terminal ID
902
external network ID (1)
903
access point–mobile terminal SA (1)
904
session ID (1)
905
link information (1)
906
external network ID (2)
907
access point–mobile terminal SA (2)
908
session ID (2)
909
link information (2)
910
a combination of (external network ID, access point – mobile terminal SA, session ID and link information) will be repeated in the following
911

Fig. 19

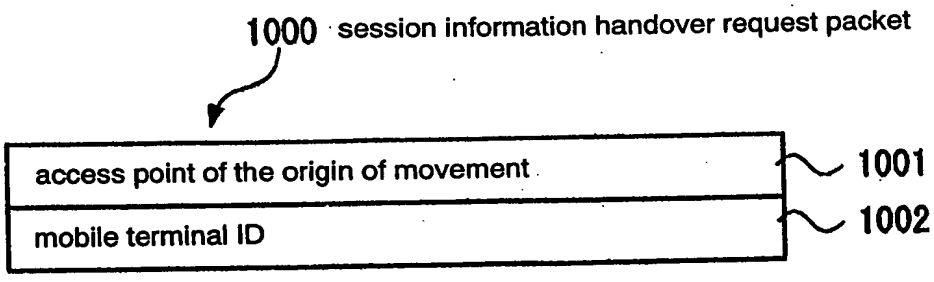

1000 session information handover request packet
access point of the origin of movement
1001
mobile terminal ID
1002

Fig.20

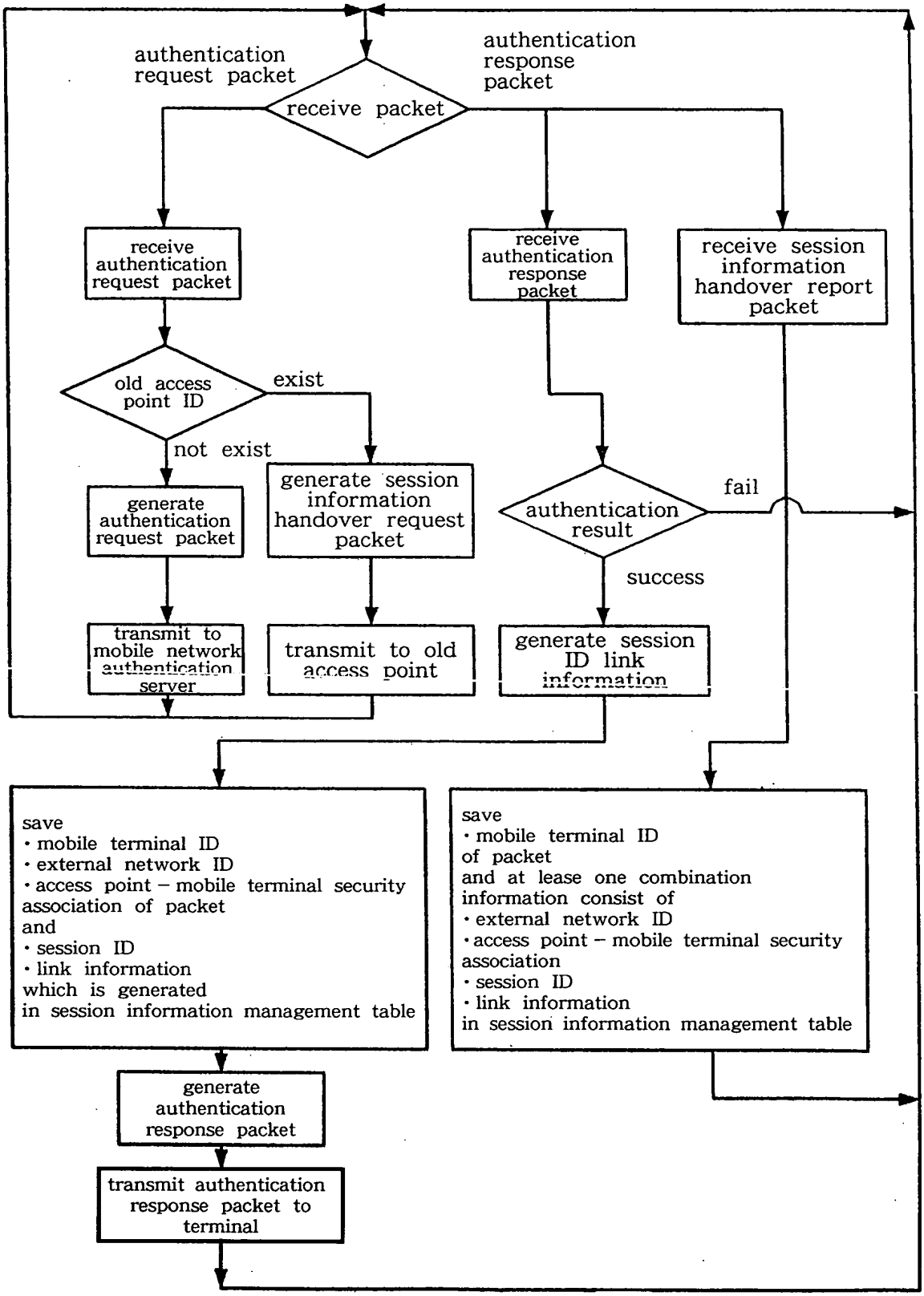

authentication request packet
authentication response packet
receive packet
receive authentication request packet
receive authentication response packet
receive session information handover report packet
old access point ID
exist
not exist
generate authentication request packet
generate session information handover request packet
authentication result
fail
success
transmit to mobile network authentication server
transmit to old access point
generate session ID link information
save
• mobile terminal ID
• external network ID
• access point – mobile terminal security association of packet
and
• session ID
• link information
which is generated
in session information management table
save
• mobile terminal ID
of packet
and at lease one combination
information consist of
• external network ID
• access point – mobile terminal security association
• session ID
• link information
in session information management table
generate authentication response packet
transmit authentication response packet to terminal

Fig. 21

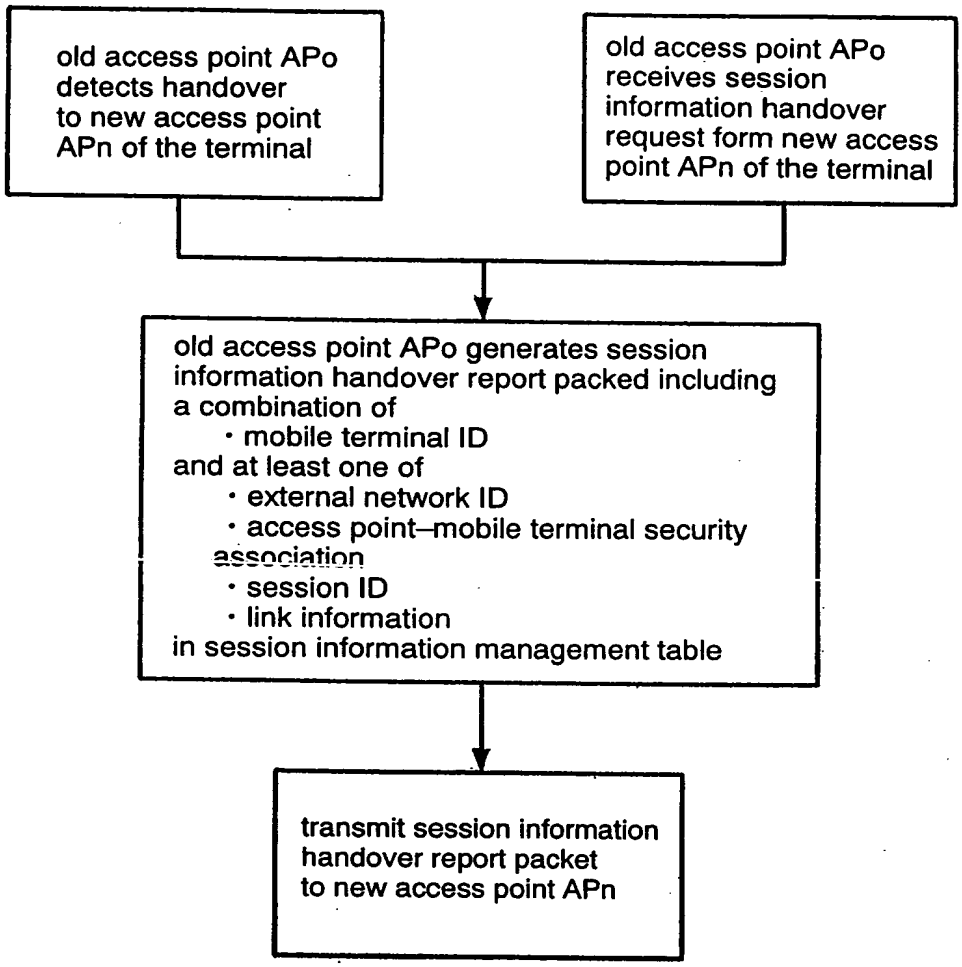

old access point APo detects handover to new access point APn of the terminal
old access point APo receives session information handover request form new access point APn of the terminal
old access point APo generates session information handover report packed including a combination of
• mobile terminal ID
and at least one of
• external network ID
• access point–mobile terminal security association
• session ID
• link information
in session information management table
transmit session information handover report packet to new access point APn

Fig. 22

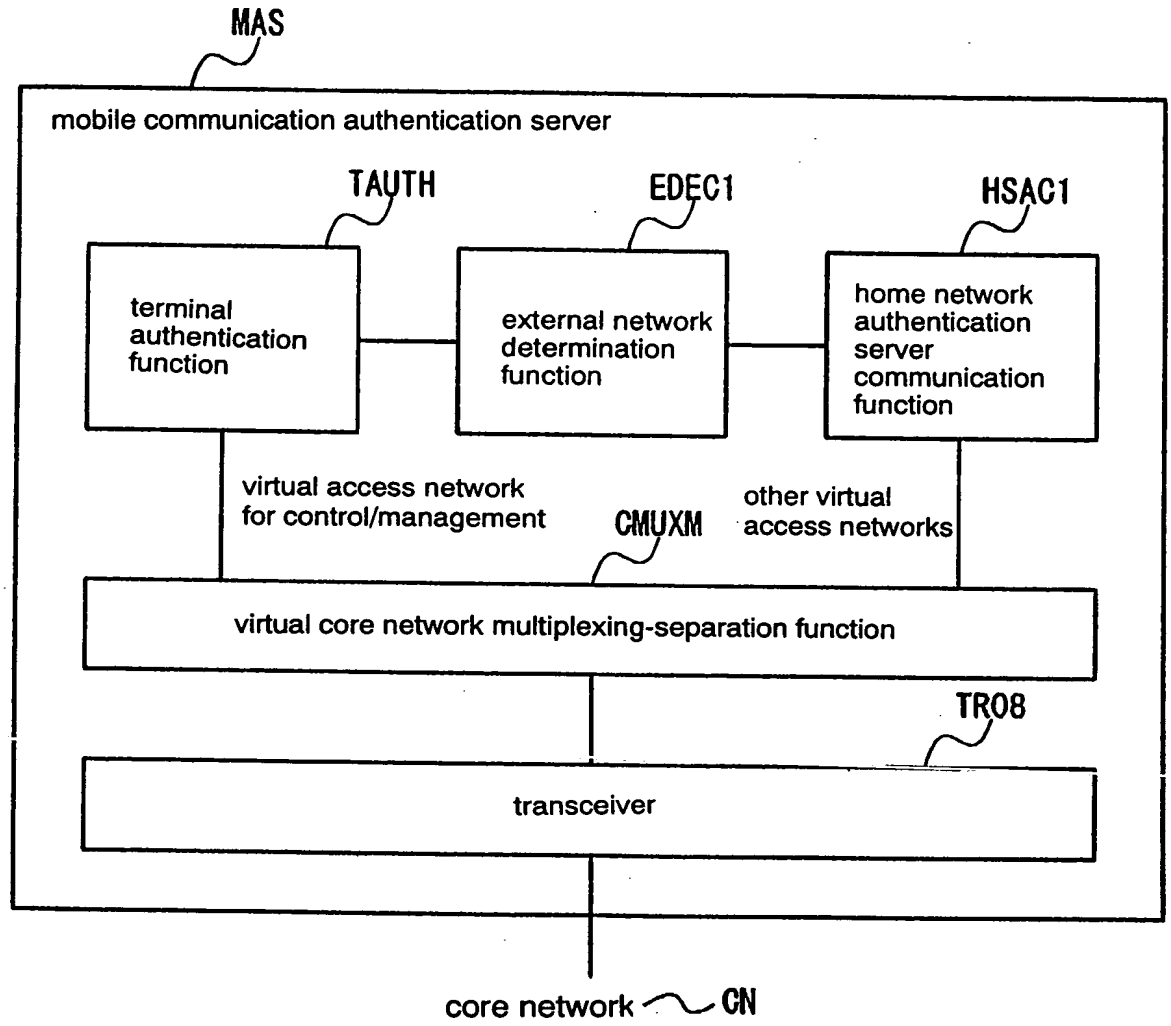

MAS
mobile communication authentication server
TAUTH
EDEC1
HSAC1
terminal authentication function
external network determination function
home network authentication server communication function
virtual access network for control/management
CMUXM
other virtual access networks
virtual core network multiplexing-separation function
TRO8
transceiver
core network
CN

Fig. 23

1100 terminal information management table

mobile terminal ID (1110)	mobile communication server – mobile terminal SA (1120)	access point – mobile terminal SA (1130)
mobile terminal #1 (1111)	Home SA#1 (1121)	SA#1 (1131)
mobile terminal #2 (1112)	Home SA#2 (1122)	SA#2 (1132)

Fig. 24

1200 home network – external network correspondence table

home network ID (1210)	external network ID (1220)
home network #1 (1211)	external network #1 (1221)
home network #2 (1212)	external network #2 (1222)

Fig. 25

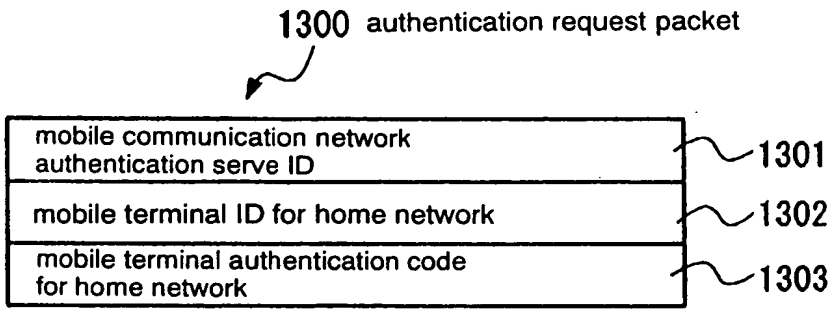

1300 authentication request packet
mobile communication network authentication serve ID
1301
mobile terminal ID for home network
1302
mobile terminal authentication code for home network
1303

Fig. 26

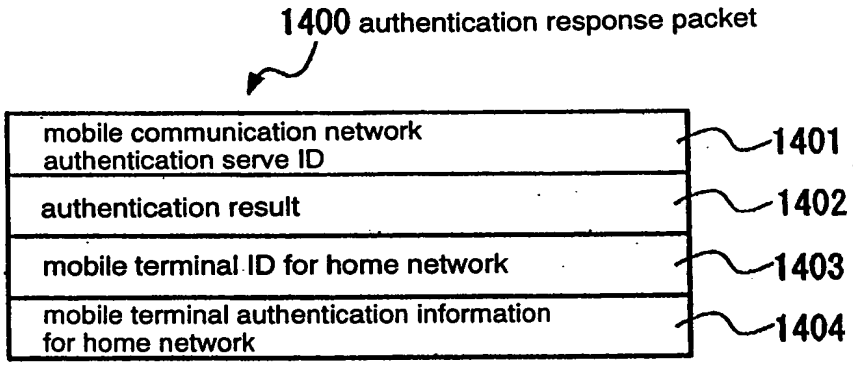

1400 authentication response packet
mobile communication network authentication serve ID
1401
authentication result
1402
mobile terminal ID for home network
1403
mobile terminal authentication information for home network
1404

Fig.27

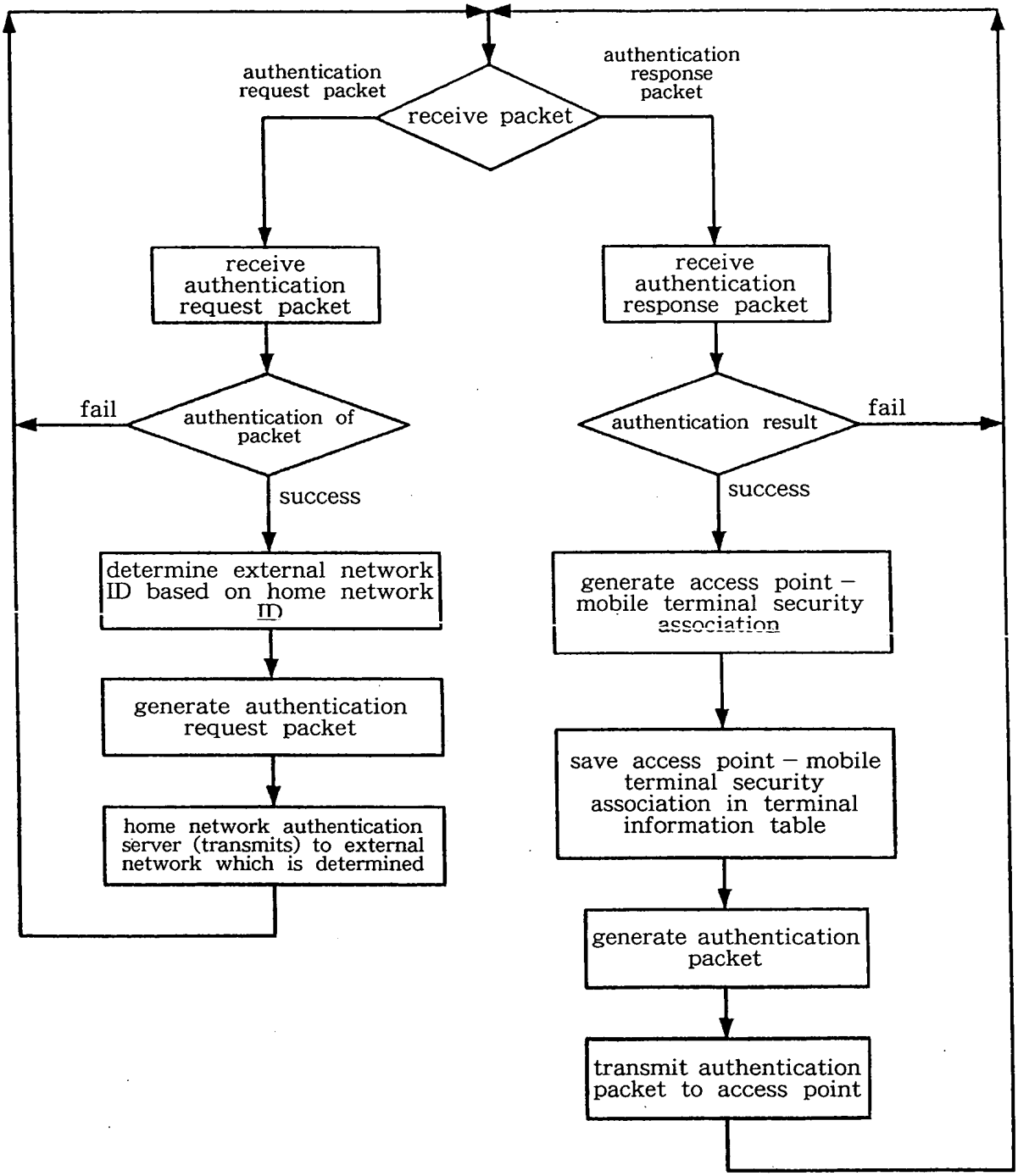

receive packet
authentication request packet
authentication response packet
receive authentication request packet
receive authentication response packet
authentication of packet
fail
success
authentication result
fail
success
determine external network ID based on home network ID
generate authentication request packet
home network authentication server (transmits) to external network which is determined
generate access point – mobile terminal security association
save access point – mobile terminal security association in terminal information table
generate authentication packet
transmit authentication packet to access point

Fig.28

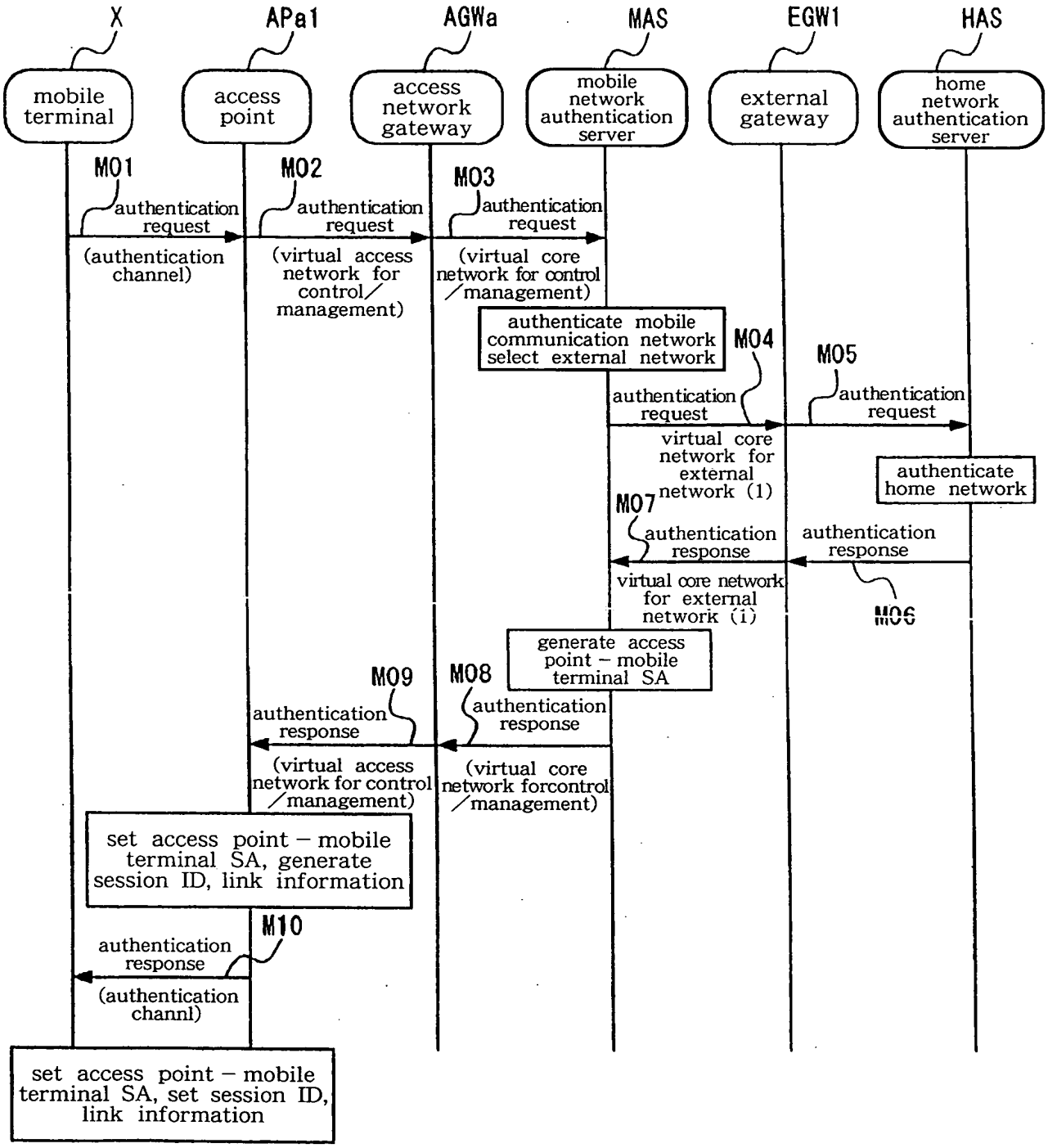

X
APa1
AGWa
MAS
EGW1
HAS
mobile terminal
access point
access network gateway
mobile network authentication server
external gateway
home network authentication server
M01
authentication request
(authentication channel)
M02
authentication request
(virtual access network for control/management)
M03
authentication request
(virtual core network for control/management)
authenticate mobile communication network select external network
M04
authentication request
M05
authentication request
virtual core network for external network (1)
authenticate home network
M07
authentication response
authentication response
virtual core network for external network (i)
M06
generate access point – mobile terminal SA
M09
authentication response
M08
authentication response
(virtual access network for control/management)
(virtual core network forcontrol/management)
set access point – mobile terminal SA, generate session ID, link information
M10
authentication response
(authentication channl)
set access point – mobile terminal SA, set session ID, link information

Fig.29

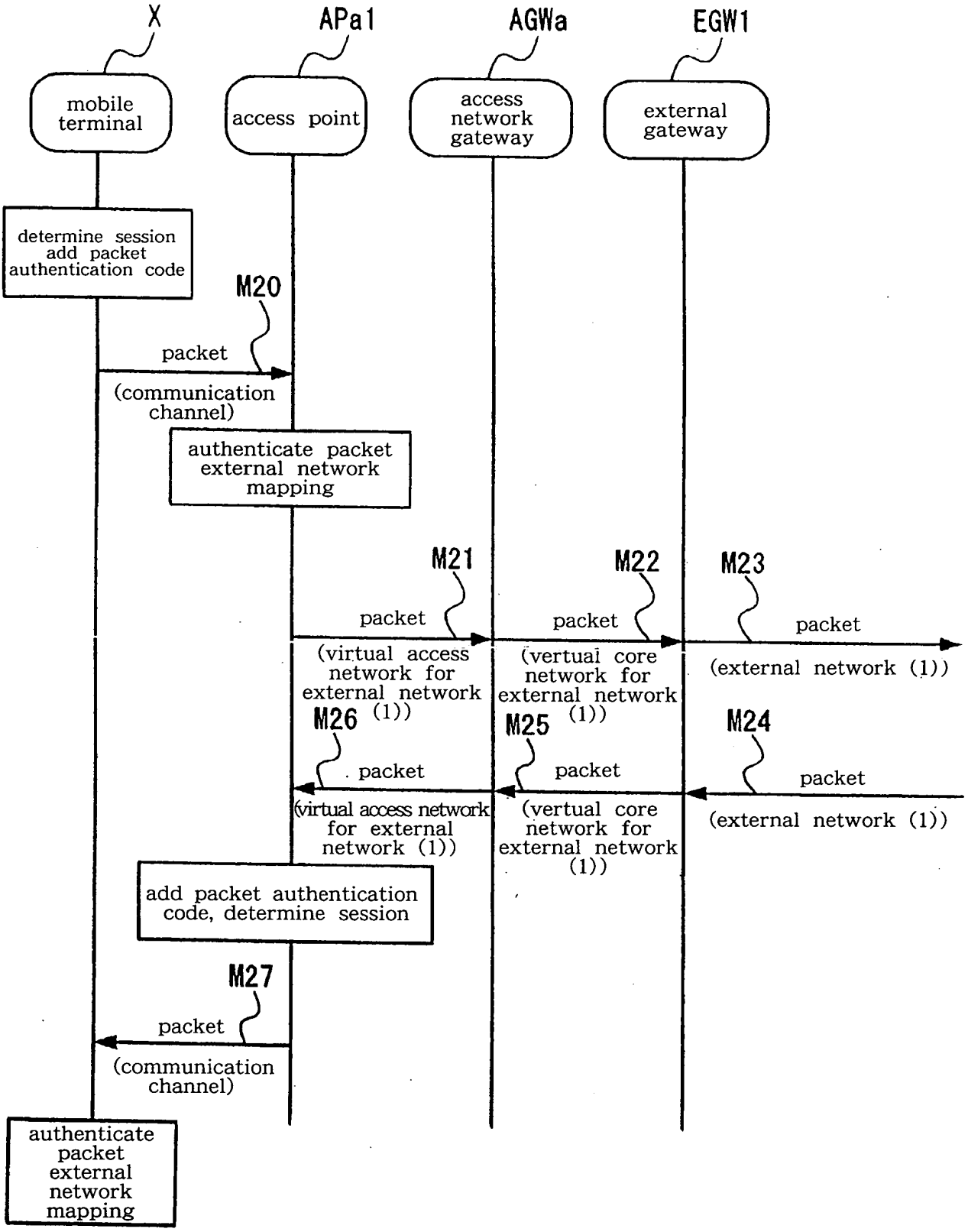

X
APa1
AGWa
EGW1
mobile terminal
access point
access network gateway
external gateway
determine session add packet authentication code
M20
packet
(communication channel)
authenticate packet external network mapping
M21
M22
M23
packet
packet
packet
(virtual access network for external network (1))
(vertual core network for external network (1))
(external network (1))
M26
M25
M24
packet
packet
packet
(virtual access network for external network (1))
(vertual core network for external network (1))
(external network (1))
add packet authentication code, determine session
M27
packet
(communication channel)
authenticate packet external network mapping

Fig.30

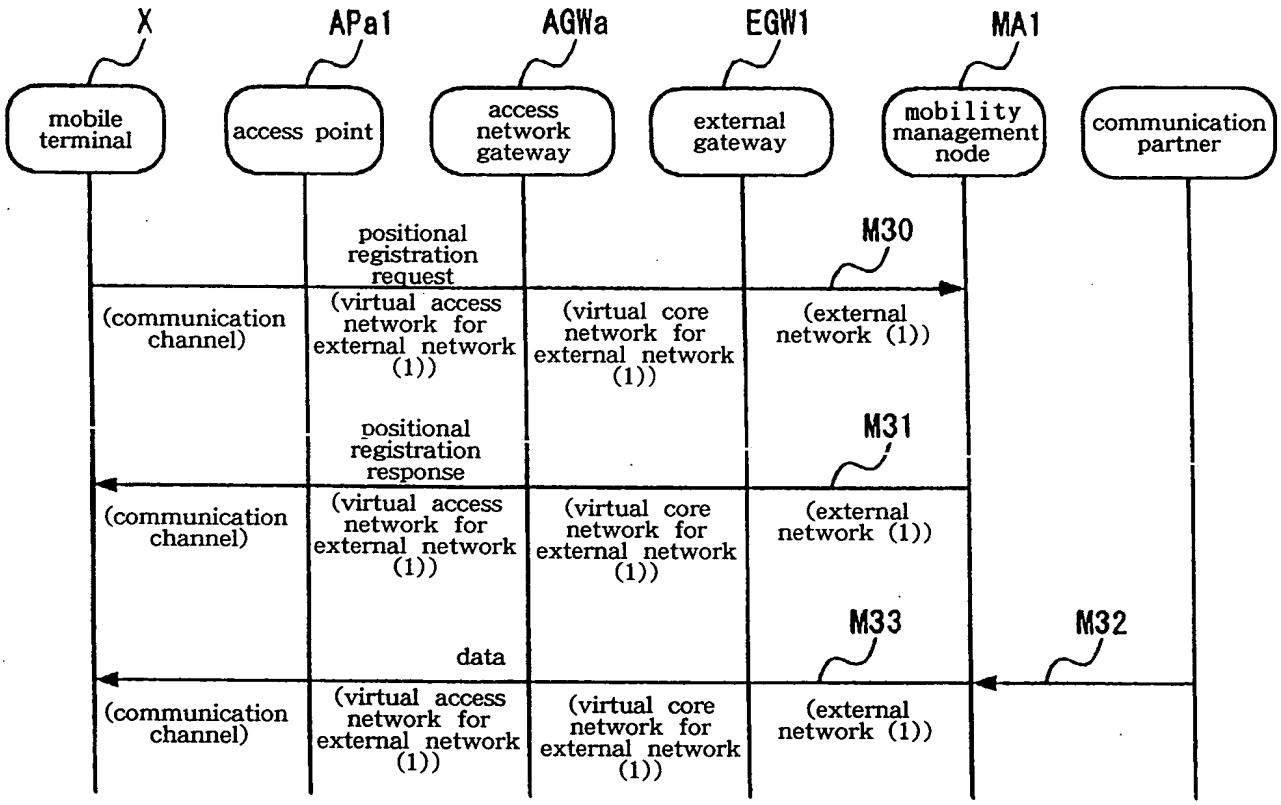

X
APa1
AGWa
EGW1
MA1
mobile terminal
access point
access network gateway
external gateway
mobility management node
communication partner
positional registration request
M30
(communication channel)
(virtual access network for external network (1))
(virtual core network for external network (1))
(external network (1))
positional registration response
M31
(communication channel)
(virtual access network for external network (1))
(virtual core network for external network (1))
(external network (1))
M33
M32
data
(communication channel)
(virtual access network for external network (1))
(virtual core network for external network (1))
(external network (1))

Fig.31

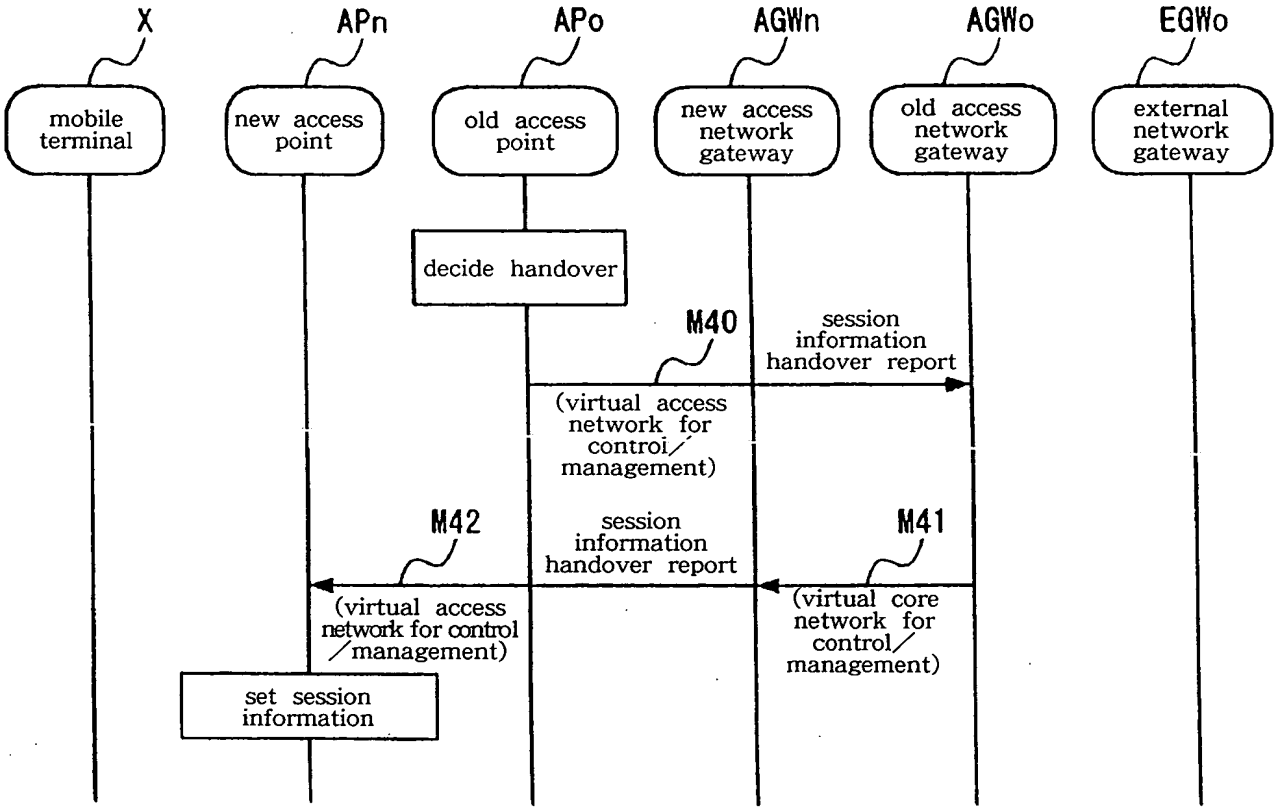

X
APn
APo
AGWn
AGWo
EGWo
mobile terminal
new access point
old access point
new access network gateway
old access network gateway
external network gateway
decide handover
M40
session information handover report
(virtual access network for control/management)
M42
session information handover report
M41
(virtual access network for control/management)
(virtual core network for control/management)
set session information

Fig.32

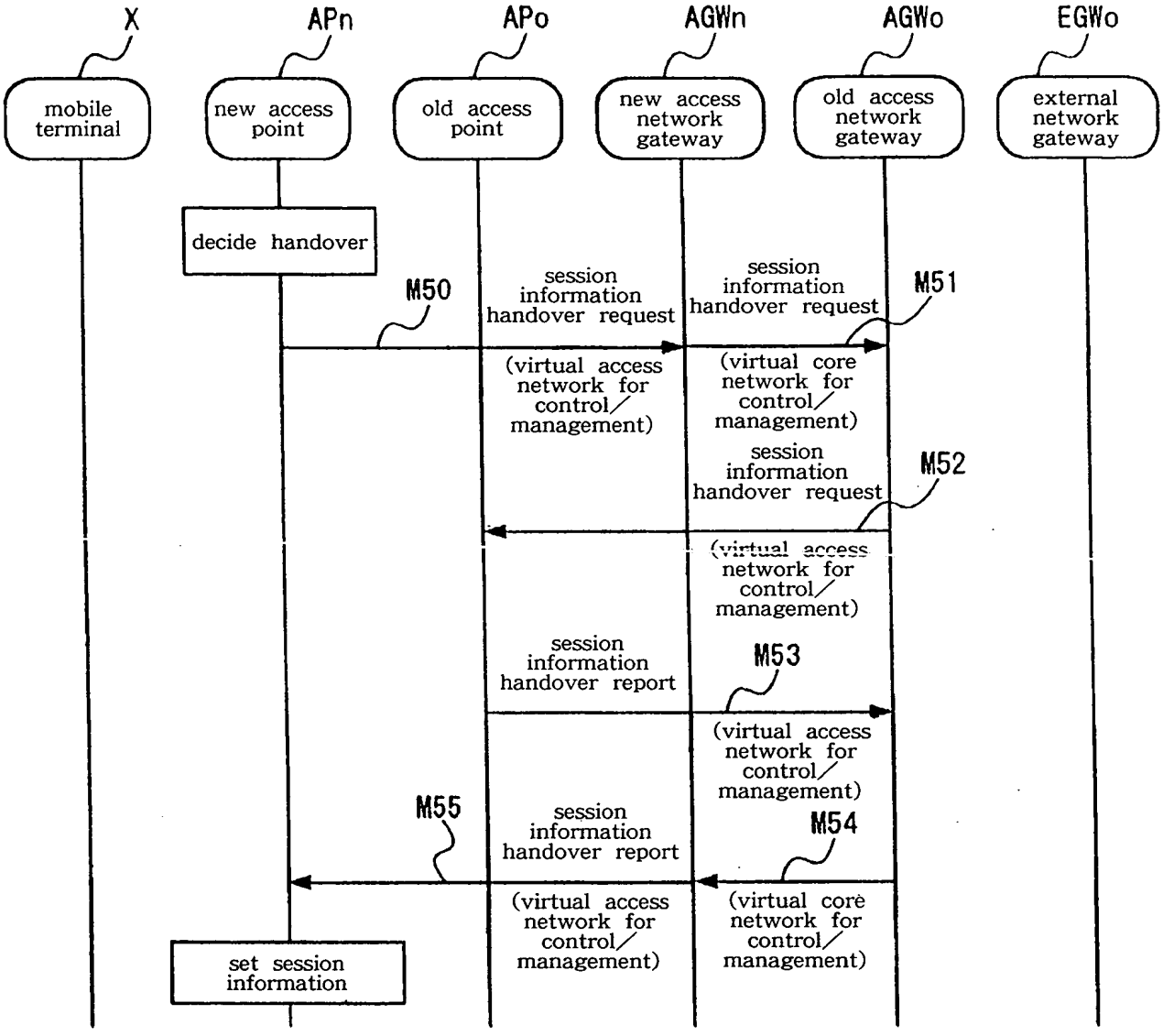

X
APn
APo
AGWn
AGWo
EGWo
mobile terminal
new access point
old access point
new access network gateway
old access network gateway
external network gateway
decide handover
M50
session information handover request
M51
session information handover request
(virtual access network for control/ management)
(virtual core network for control/ management)
session information handover request
M52
(virtual access network for control/ management)
session information handover report
M53
(virtual access network for control/ management)
M55
session information handover report
M54
(virtual access network for control/ management)
(virtual core network for control/ management)
set session information

Fig.33

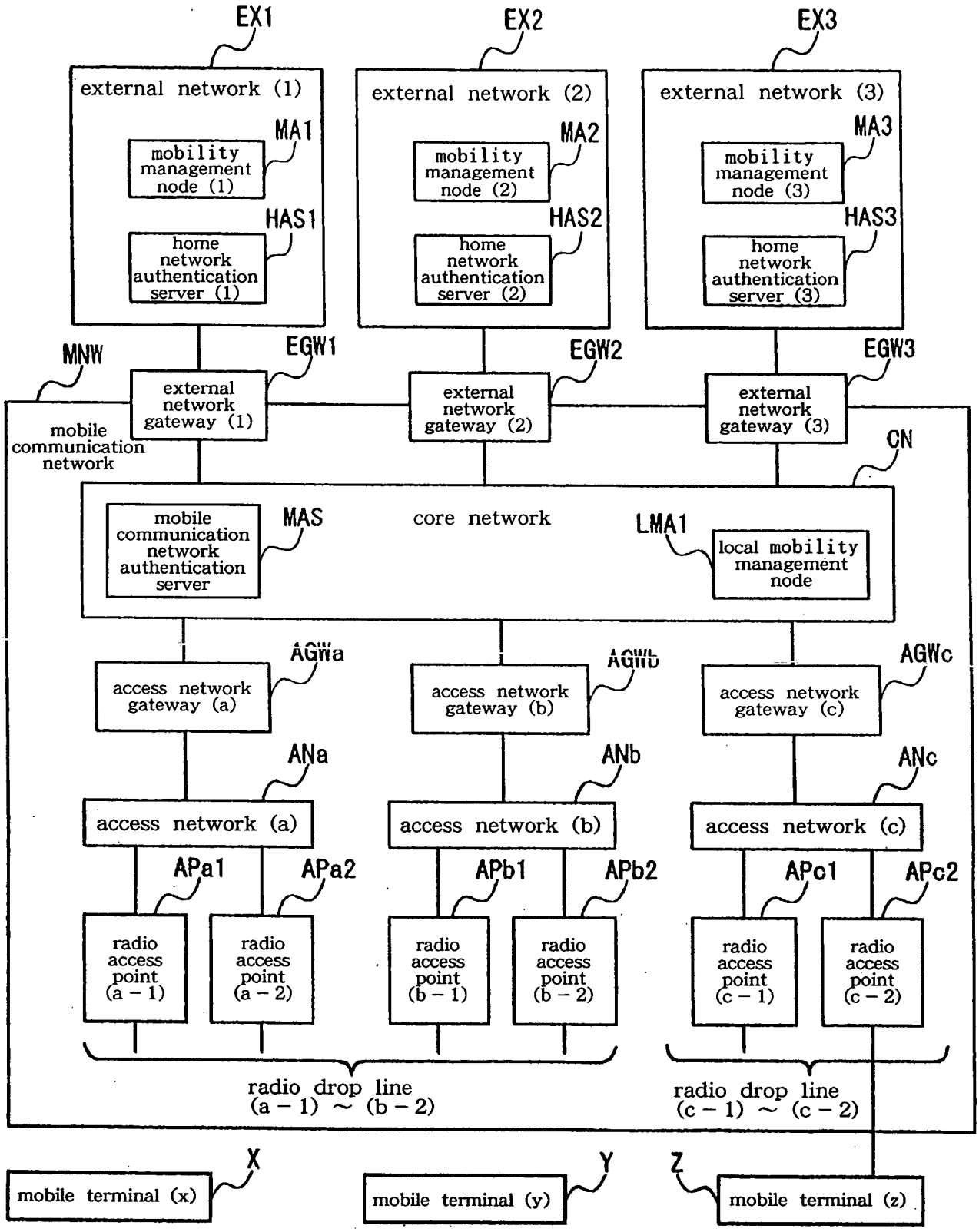

EX1
external network (1)
MA1
mobility management node (1)
HAS1
home network authentication server (1)
EX2
external network (2)
MA2
mobility management node (2)
HAS2
home network authentication server (2)
EX3
external network (3)
MA3
mobility management node (3)
HAS3
home network authentication server (3)
MNW
mobile communication network
EGW1
external network gateway (1)
EGW2
external network gateway (2)
EGW3
external network gateway (3)
CN
core network
MAS
mobile communication network authentication server
LMA1
local mobility management node
AGWa
access network gateway (a)
AGWb
access network gateway (b)
AGWc
access network gateway (c)
ANa
access network (a)
ANb
access network (b)
ANc
access network (c)
APa1
APa2
APb1
APb2
APc1
APc2
radio access point (a − 1)
radio access point (a − 2)
radio access point (b − 1)
radio access point (b − 2)
radio access point (c − 1)
radio access point (c − 2)
radio drop line (a − 1) ~ (b − 2)
radio drop line (c − 1) ~ (c − 2)
X
mobile terminal (x)
Y
mobile terminal (y)
Z
mobile terminal (z)

Fig. 34

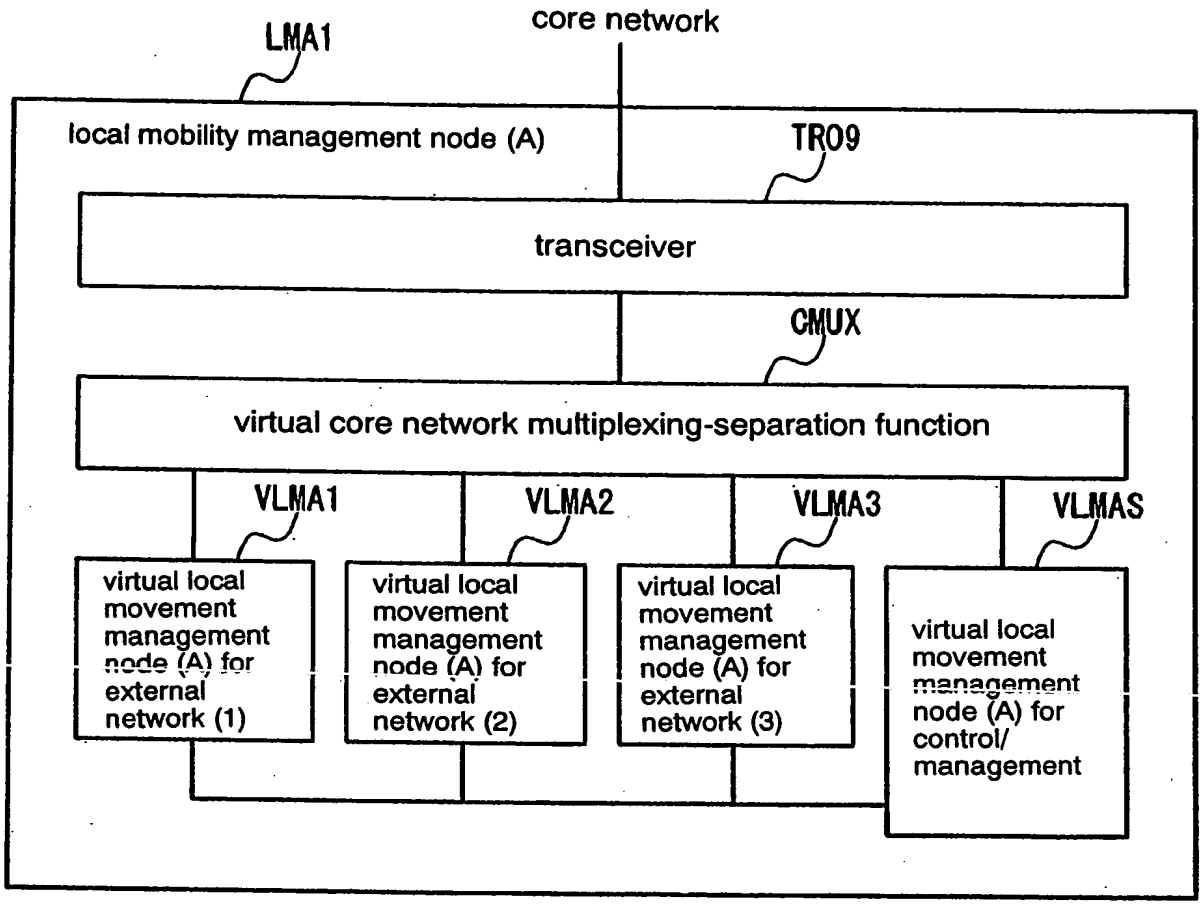
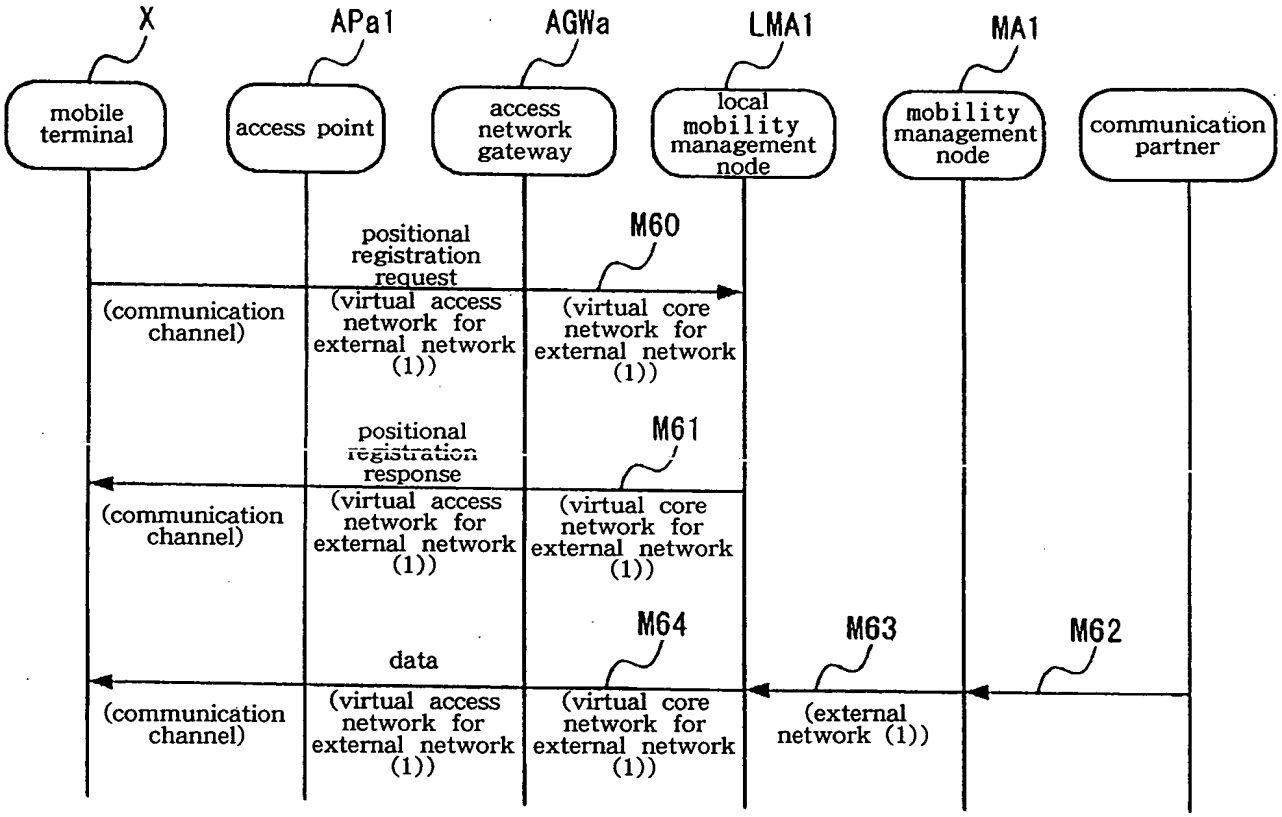

LMA1
core network
local mobility management node (A)
TRO9
transceiver
CMUX
virtual core network multiplexing-separation function
VLMA1
VLMA2
VLMA3
VLMAS
virtual local movement management node (A) for external network (1)
virtual local movement management node (A) for external network (2)
virtual local movement management node (A) for external network (3)
virtual local movement management node (A) for control/ management

Fig.35


X
APa1
AGWa
LMA1
MA1
mobile terminal
access point
access network gateway
local mobility management node
mobility management node
communication partner
positional registration request
M60
(communication channel)
(virtual access network for external network (1))
(virtual core network for external network (1))
positional registration response
M61
(communication channel)
(virtual access network for external network (1))
(virtual core network for external network (1))
M64
M63
M62
data
(communication channel)
(virtual access network for external network (1))
(virtual core network for external network (1))
(external network (1))